

Lidar Orbital Angular Momentum Sensor (LOAMS)

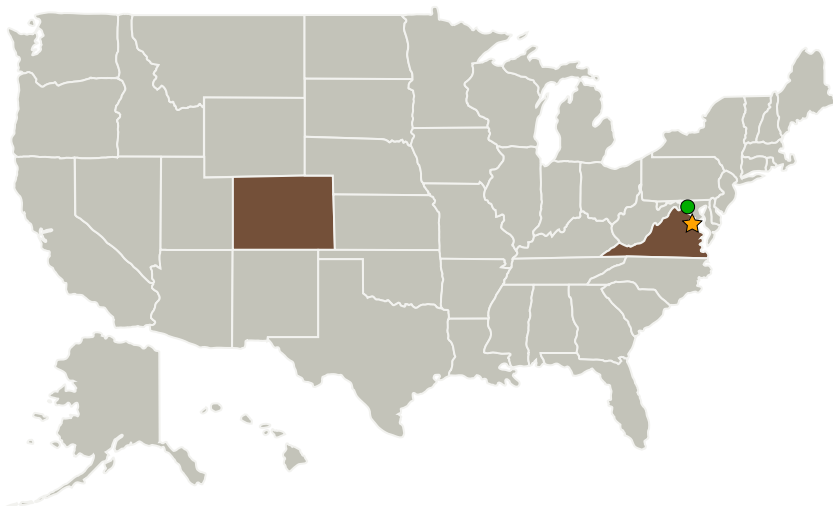
Completed Technology Project (2015 - 2017)



Project Introduction

The recognition in recent decades that electromagnetic fields have angular momentum (AM) in the form of not only polarization (or spin AM) but also orbital (OAM) has resulted in an explosion of theoretical and experimental studies to understand the possible implications of these fields and their applications. The first applications have been achieved in astronomy (exoplanet vortex coronagraph), particle manipulation (optical tweezers), and encoding information on lasers (optical communication). OAM is a previously unrecognized degree of freedom for light that can be readily controlled, manipulated, and detected in laser beams characterized by helical wavefronts that rotate forward like a screw (vortex beams). The objective of the proposed effort is to utilize vortex beams to significantly increase the information that can be obtained from backscatter lidars. A lidar receiver will be developed that incorporates an optical angular momentum mode sorter. This will provide improved daytime performance by the spatial coherency filtering of background light and allow single scattering to be uniquely distinguished from multiple scattering in turbid environments (dense clouds, coastal waters). The latter is analogous to the exoplanet coronagraph: the lidar beam will be detected to greater optical depth into turbid media because the bright haze of multiple scattering will be eliminated. The effort will go on to demonstrate how examples of vortex beams can be created that will interact with the atmosphere in different ways, improving overall lidar performance. This three year effort will bring the measurement concept and receiver technology from a TRL 2 to 4.

Primary U.S. Work Locations and Key Partners



ALHAT - ETD Autonomous
Landing & Hazard Avoidance
Tech Earth Science Technology
Office

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	3
Technology Areas	3
Target Destination	3

Lidar Orbital Angular Momentum Sensor (LOAMS)

Completed Technology Project (2015 - 2017)



Organizations Performing Work	Role	Type	Location
★ NASA Headquarters(HQ)	Lead Organization	NASA Center	Washington, District of Columbia
Ball Aerospace & Technologies Corporation	Supporting Organization	Industry	Boulder, Colorado
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations

Colorado

Virginia

Images

**91-1373479894122.png**

ALHAT - ETD Autonomous Landing
& Hazard Avoidance Tech Earth
Science Technology Office
(<https://techport.nasa.gov/image/5096>)

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Center / Facility:

NASA Headquarters (HQ)

Responsible Program:

Advanced Component Technology Program

Project Management

Program Director:

Pamela S Millar

Program Manager:

Amber E Emory

Principal Investigator:

Carl Weimer

Co-Investigators:Yongxiang Hu
Jennifer Sheehan

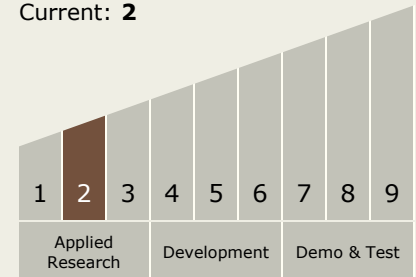
Lidar Orbital Angular Momentum Sensor (LOAMS)

Completed Technology Project (2015 - 2017)



Technology Maturity (TRL)

Start: 2
Current: 2



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.5 Lasers

Target Destination

Earth